

Working Group 5 – Resource Analysis

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Vehicle Subsystem Reliability Estimation Using Physics-based Modeling and Simulation

[27 Oct 15, 1330-1400, Rm 4]

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Keywords: Reliability, Stress-Strength, Modeling

ABSTRACT: Reliability of tactical wheeled vehicles plays a critical role in the decision making process for the management of an efficient, modern and cost effective Army vehicle fleet. Reliability estimates have been classically based upon sample data collection of fielded vehicles and test data collected from reliability testing. Many gaps in the reliability data exist for vehicles when insufficient field data is collected and no test data are available. These data gaps have been attempted to be filled by making assumptions about system similarity and by use of simple formulas based upon changes in vehicle weight. Reliability estimation based upon the physical attributes of stress and strength and employing modeling and simulation adds a high degree of scientific rigor to the process of estimating vehicle and vehicle sub-system reliability.

This reliability estimation technique uses a new approach based upon field data collection and physics-based modeling. The process begins with developing a system level block diagram. Failure data is obtained for a vehicle with similar subsystems and the failure rate calculated for each subsystem. A terrain profile is created that reflects actual field usage and a dynamics model is run to generate a stress profile for the subsystems. The subsystem strength is generated by calculating the probability of failure for a mission, f_j and then using that as input into the inverse of the cumulative distribution function (cdf) of the stress profile. The dynamics model is modified to reflect changes in the system, such as weight, equipment and mission profile. A new subsystem stress profile is generated. Then the subsystem strength is used as input to the new stress profile cdf to generate the P_{new} . The P_{new} is used to estimate the new subsystem failure rate and is summed with the other subsystem failure rates to create a new system reliability estimate.

Army Financial Transparency and Cost Management

[27 Oct 15, 1400-1430, Rm 4]

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Keywords: Financial Transparency, Cost Management (CM), Resource Informed Decision

ABSTRACT: The Army is committed to financial transparency, achieving greater efficiencies and delivering best-in-class products and services. Army leaders from all Financial Management (FM) and non-FM organizations are actively engaged in driving FM transformation by implementing Cost Management (CM) capabilities across all levels and spans of control and influence. CM analytical decision support capabilities help maximize the use of limited resources and improve performance. Recent developments in Army Financial Management Optimization (AFMO), the formation of the Cost Management Steering Group, standardized cost management processes, and Army enterprise ERP cost framework illustrate the commitment of Army senior leaders.

The standardized cost management business practices and processes provide resource managers and operational managers with relevant cost and performance knowledge and business intelligence to manage and maximize value in their business operations while delivering products and services more efficiently and effectively. The CM capabilities include cost modeling, cost planning, measurement, analyses, and control methods integrated across Army's end-to-end processes.

The Cost Management capabilities will guide, influence, and accelerate the optimization of the FM enterprise into a high-performing organization with integrated, enterprise-wide cost and performance management analytical capabilities that ensure the Army's mission success as good stewards of the nation's resources.

Optimal Stationing of Army Flatcars to Meet Deployment Requirements

[27 Oct 15, 1515-1545, Rm 4]

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Keywords: Railcar, Flatcar, DODX, Stationing, Cost Analysis, Integer Programming, Optimization

ABSTRACT: This analysis determines an optimal stationing plan for Army railcars (specifically 1,671 DODX flatcars) at Army installations and ammunition depots to meet deployment requirements. Army flatcars were purchased to provide rapid deployment capabilities in the event of a large-scale contingency. However, since OPERATION IRAQI FREEDOM the flatcars have not been stationed at any particular installation or ammunition depot and thus risk not being available where they are needed during the first several days of a contingency.

SDDCTEA developed and recommended the Army implement the DODX Railcar Stationing Plan to improve the fort-to-port portion of a major contingency deployment; the improvement, as validated by detailed analysis, results from optimal positioning of DOD-owned railcars. Analysts determined the requirement using the Army's Rapid Expeditionary Deployment Initiative (REDI), determined railcar starting conditions using data provided by industry and individual installations, and built an Integer Program to "match" railcars to requirements such that requirements are satisfied and empty-car positioning distances are minimized.

Engineered Resilient Systems Tradespace Toolbox and Workflow

[27 Oct 15, 1545-1615, Rm 4]

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Keywords: Engineered Resilient Systems, Modeling and Simulation, CREATE

ABSTRACT: The emergence of new and innovative threats against military systems requires the Department of Defense (DoD) to have the capability to rapidly adapt to meet those threats while maintaining force overmatch. The Engineered Resilient Systems (ERS) program seeks to provide tools and capabilities that allows the entire DoD the ability to quickly design, develop, test, and build trusted, flexible, and resilient systems. The U.S. Army Corps of Engineers (USACE) Engineer Research and Development Center (ERDC) has developed software tools, as well as a systems engineering framework and workflow, that supports system development from Pre-Milestone A analysis throughout the lifecycle of the system.

The ERS Tradespace Toolbox is a web-based tool, written primarily in Python, which provides a collaborative environment for engineers and program managers (PMs) to design and support a system throughout its entire lifecycle. The tools allow users to do early system requirements definition as well as initial system decomposition into subsystems. From there, the tool provides the ability to create initial low fidelity parametrics for system verification as well as providing data visualization tools in order to understand the dependencies of the system's components. The tool then allows engineers to leverage existing high-fidelity physics models to better understand the system's Measures of Performance (MoP's). These results can be used to build correlation plots, run regressions, facilitate Design of Experiments (DoE), and ultimately leverage high-performance computing resources to generate very large tradespaces. The toolbox then allows this large data set to be visualized and pared down to viable system alternatives. Utilizing a variety of data visualization capabilities or analytical tools within the toolbox, a final tradespace containing the most valuable system alternatives can be created and exported to Excel or a number of other file types. This workflow has been validated using a legacy system and work continues to improve the toolbox's usability and accessibility throughout the DoD.

Total NEC Cost Visibility (TNCV)

[27 Oct 15, 1615-1645, Rm 4]

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Keywords: Information Technology, GFEBS, Cost Capture

ABSTRACT: In May 2014, the Network Enterprise Technology Command began piloting the Total Network Enterprise Center (NEC) Cost Visibility (TNCV) project. The TNCV project is designed to allow the Army to capture its Information Technology (IT) costs by installation at the Command, Control, Communications, Computers and Information Management (C4IM) service level. Currently there is no mechanism for the Army to accurately capture expenditures on IT services. The TNCV pilot phase consisted of one CONUS and one OCONUS NEC. Using the data from the pilot phase we are able to link cost with performance of IT services. TNCV also allows to make comparisons between NECs to see which are more efficient relative to each other. TNCV will empower Senior Leaders to make informed, data driven decisions regarding how installations are resourced on IT services. As the Army transforms its IT infrastructure, cost decisions based on the TNCV project will be critical since historic budgets will no longer be relevant to determining future budget needs. Overall, the desired outcome is to improve strategic and operational decision-making, enhance risk mitigation capabilities, strengthen resourcing and requirements justification, and support financial transparency and audit readiness.

Military Wheeled Vehicle Weight Estimation With Condition Based Maintenance Sensor Data

[28 Oct 15, 1015-1045, Rm 4]

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Keywords: Weight Estimation, Machine Learning, Condition Based Maintenance, Mobility Power Modeling, Empirical Data Modeling, Machine Learning

ABSTRACT: Knowing military wheeled vehicle cargo weights is important for both operation planning and estimation of vehicle reliability, mobility and maintainability. Due to the limitation and practicality of physically weighing each truck frequently across a fleet, truck cargo weight estimation has been an engineering barrier and a technical challenge.

In this analysis, three engineering approaches have been studied based upon data availability and precision requirements. The first method is based upon a power demand and power supply mobility model which estimates one optimal vehicle weight so that power demands from rolling resistance, slope climbing, aero drag and acceleration would equal to engine power output. The second method is based upon an empirical energy efficiency model with field vehicle engine sensor data. This method identifies vehicle energy coefficients and the major input factors. As one key input factor, vehicle weight can be projected from a 2 dimensional or 3 dimensional empirical coefficient model. The last method is by leveraging the latest data mining and machine learning technology. A few supervised machine learning methods have been compared and combined for best estimation results, such as: a dynamic neural network, a non-linear regression, a nearest neighbor classification and a Naive Bayes and support vector method.

This research concludes with practical application tips to select a best method for military truck operation weight estimation with acceptable precision depending on data availabilities.

French Army Capabilities Rebalance using HR Data

[28 Oct 15, 1045-1115, Rm 4]

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Keywords: Resource Analysis, Manpower, Current Operations

ABSTRACT: Faced with the worst terrorist attacks on its national soil in decades, the French Army has been massively deployed over national territory since January 2015, in support of security forces. Meanwhile, overseas commitments remained at a high level, especially throughout Africa. Therefore, Army manpower had to be increased. Faced with the responsibility to provide several options, the Army Staff (Plans Division) had to decide which operational branches would benefit from this new manpower, with a twofold objective: to face present commitments without wearing down human resources, and to keep an Army model fit for a high intensity conflict in the foreseeable future. Previous staff work was based on Land Forces Command reports, which provided unit-based analysis of activities. This data failed to depict with accuracy the reality of activities at the individual soldier level. Therefore, Plans Division call upon BARO to provided fact-based insight into Army activities.

BARO built its answer on the data held by FR Army HR information system CONCERTO. Using several strategies, it extracted all the data related to soldiers individual deployments to provide an actual depiction of how operational branches were contributing to homeland security and overseas operations. The size of the data was way over Excel capabilities. BARO relied on SAP Business Objects extractions, the creation of a dedicated MySQL database, data processing code in .NET language, and finally R code for data presentation. It revealed that what soldiers experienced on an individual basis was very different from what could be expected by watching at unit rotations only. Hence, the capabilities rebalance and the manpower flow have been reengineered to build an Army both capable of sustaining present commitments over a long time, and to keep key capabilities for high intensity war fighting.

Cost of Readiness

[28 Oct 15, 1115-1145, Rm 4]

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Keywords: readiness cost, training, readiness level

ABSTRACT: The Department of Army currently has difficulty articulating the relationship between resourcing levels and Army readiness to external stake holders such as the Department of Defense and Congress. The fielding of the General Fund Enterprise Business System (GFEBS) has provided a more visibility as to how the Army executes its' funding. The challenge is linking costs with readiness. Lag times exist before the impact on readiness of reductions or increases in funding become apparent. For example, reductions in the number of depot overhauls can eventually impact of equipment readiness and training readiness.

There are initiatives in progress to develop approaches for assessing the costs of readiness: (1) the cost of training readiness Operational Planning Team (OPT) (G-3/5/7, PA&E and (ASA (FM&C) that addresses the cost of training readiness (2) a more overarching Rand study for the ASA (FM&C) assessing the costs of strategic readiness. The cost of training readiness OPT has developed a map of the Planning, Programming, Budgeting, Execution (PPBE) process as it pertains to training readiness and identified friction points in the process as well as proposed courses of action to improve the process of generating more accurate requirements for desired levels of readiness. The OPT established a cost structure for training to provide a consistent methodology to represent unit training costs and is working towards establishing objective T-level assessments to correlate training activity and cost with readiness levels. The Rand study is focused on an approach to link costs and readiness for other significant portions of the Army budget by developing a high-level model relating both generating force capability and capacity and operational Army capabilities and resource levels to Army readiness.

US Army Input to NATO SAS-113/RST-009 Future Defence Budget Constraints: Challenges and Opportunities

[28 Oct 15, 1300-1330, Rm 4]

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Keywords: Defense Spending, Budget, Capability Portfolio Review (CPR), Long-range Investment Requirements Analysis (LIRA), NATO

ABSTRACT: As part of its current strategy, the North Atlantic Treaty Organization (NATO) has recognized complex changes in the world leading to significant security challenges, but affirms that its “essential mission will remain the same: to ensure that [NATO] remains an unparalleled community of freedom, peace, security, and shared values.” However, declining defense spending by member countries since the Great Recession is risking NATO’s ability to accomplish that mission. One NATO response has been to encourage the sharing of best resource management practices among its member nations in the hopes that expanded implementation of these practices may lessen the harmful impacts of defense resourcing constraints on national and, consequently, NATO defense capabilities.

The NATO SAS-113/RST-009 Future Defence Budget Constraints: Challenges and Opportunities study team was commissioned by NATO to identify and evaluate various resource strategies previously implemented by member countries and to identify a set of best resource management practices for mitigating risks associated with defense budget constraints. The U.S. study team (the U.S Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC), in coordination with Programs and Resources Department, Headquarters Marine Corps) has researched current and planned U.S. national defense budgets and the impact of defense budget constraints on national defense capability, and has identified resource strategy initiatives implemented in response to resourcing constraints. The Army portion of this work will highlight two initiatives, the Capability Portfolio Review (CPR) and the Long-Range Investments Requirements Analysis (LIRA).

In this presentation, a background on the NATO study will be presented along with a review of the current defense budget constraints and an explanation of how the Army continues using CPR and LIRA as the primary mechanisms to identify capability requirements and inform defense spending on Army capabilities in light of budget reductions.

Army Oil Analysis Program Cost Benefit Analysis

[28 Oct 15, 1330-1400, Rm 4]

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Keywords: AOAP, Cost Benefit Analysis, Oil Analysis

ABSTRACT: In 2004, DA G-4 directed the closure of several Army Oil Analysis Program (AOAP) labs following the unfunded transfer of the labs from Installation Management Command (IMCOM) to Army Materiel Command (AMC). Due to the reduction in sample processing capacity, Tactical Wheeled Vehicles (TWVs), construction equipment and generators were all dis-enrolled and converted to Lubrication Order directed oil changes. Six alternatives were considered within the study to include: hard time oil changes; AOAP; AMSAA developed oil condition algorithm; portable oil analyzers (two different variants); and privatized oil sampling. The purpose of the CBA was to not only identify the least cost alternative and to compare qualitative aspects of each Course of Action (COA). The original sample set for the study was the Heavy Equipment Transporter. However, a sensitivity was conducted to include the Family of Medium Tactical Vehicles. Initially AOAP was found to be the least cost alternative. Once additional assets were included and qualitative benefits considered, portable analyzers proved to be the favored COA.

Economic Impact Analysis– Assessing the Impact on Local Communities due to Stationing Actions

[28 Oct 15, 1400-1430, Rm 4]

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Keywords: Economic Impact; Stationing; Stationing Decisions, Installations, Local Communities

ABSTRACT: The Department of Defense (DoD) has conducted several rounds of Base Realignment and Closures (BRAC) with the last round being conducted in 2005. Since then the U.S. Army has reduced its force size, which has created excess infrastructure capacity on many Army installations. Due to budget constraints, DoD has asked Congress to authorize another round of BRAC. One of Congress' BRAC criteria that must be considered is the economic impact of realignment or closure actions on surrounding local communities. The Army must also consider economic impact of any day-to-day stationing actions outside of a BRAC.

The Center for Army Analysis (CAA) has extensive experience with stationing analyses from prior BRAC rounds. CAA has conducted considerable analysis in the recent European Infrastructure Consolidation (EIC) effort. CAA developed tools that were used for stationing analysis during BRAC 2005 and modified them for use in EIC. CAA recognizes that its stationing tools must be revised to meet today's challenges and is conducting a focused multi-year effort to do so. As a part of this effort, CAA is developing an Economic Impact Tool (EIT). During BRAC 2005, DoD utilized commercial software to estimate the economic impact by accounting for the employment and population changes to a community. CAA initiated a project with the George Mason University's Operations Research Department to develop EIT to account for differences across Army Installations. We will explore multiple attributes of economic impact using authoritative databases and a documented and verified methodology.

Non-Army Tenants– Defining the Impact on Army Installations

[28 Oct 15, 1445-1515, Rm 4]

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Keywords: Tenants; Installations; Common Levels of Support; Support Agreements

ABSTRACT: Several Army installations have a significant number of non-Army tenants residing on them who receive various services from the installations. Non-Army tenants have historically enjoyed a cost savings when they move to an Army installation, compared to leasing or providing their own services, because the Army has paid for some of their common levels of support (CLS) by way of Installation Management Command (IMCOM). These tenants may also require additional services above and beyond CLS. The Department of Defense Instruction (DoDI) Support Agreement (4000.19) states that each service should collect funds for any services that can be directly attributed to the sister services' tenants residing on their installations. Army installations currently lack standard guidance on how to accurately measure services rendered and collect reimbursement from these non-Army tenants. With increasing budget cuts, the Army must look across its installations to determine and implement best practices that will ensure accurate measurement and reimbursement from tenants to enable cost savings.

The Center for Army Analysis (CAA) is conducting an analysis that seeks to define the current state of non-Army tenants on installations and provide policy recommendations regarding the need for oversight and payment enforcement through the use of Inter-service Support Agreements (ISA).

Cost and Affordability Analysis - Long Range Precision Fires (LRPF) Analysis of Alternatives (AoA)

[28 Oct 15, 1515-1545, Rm 4]

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Keywords: AoA, cost, optimization

ABSTRACT: The Office of the Secretary of Defense, Cost Assessment and Program Evaluation (OSD CAPE), initiated the LRPF AoA in 2013. The U.S. Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC) established a study team to examine alternatives that could mitigate the capability gap resulting from the cancellation of the Army Tactical Missile System (ATACMS) program and the 2019 moratorium against cluster munitions. Trade space analysis within the alternatives was a key aspect of the study.

The study team examined tradeoffs between schedule, performance, and cost for all the alternatives. The LRPF Cost Team focused on calculating the life cycle cost estimate (LCCE) and average procurement unit cost (APUC) for alternatives based on predetermined production schedules. With these schedules, some of the alternatives exceeded the affordable budgetary projections. The LRPF Cost Team then modified the production schedules for every alternative, keeping all of the annual procurement cost estimates below the annual affordable budgetary projections. This step provided decision makers more tradeoffs.

This presentation will discuss how the LRPF Cost Team studied cost and affordability as well as how the results were incorporated with the aged inventory analysis. It will include the methodologies for the initial estimates and sensitivity analysis. Limitations, assumptions, various challenges, and lessons learned for this study will also be addressed.

Life Cycle Cost Analysis for Engineered Resilient Systems

[28 Oct 15, 1545-1615, Rm 4]

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Keywords: Cost Analysis, Tradespace Analysis

ABSTRACT: The life cycle cost of a system is a primary concern of the Department of Defense (DoD). As part of its charter, the Engineered Resilient Systems (ERS) program develops engineering concepts, science, and design tools to enable protected, trusted and assured weapon systems. To achieve this, cost information for a large number of alternative designs are analyzed in context of a multidimensional, system and portfolio tradespace. Many current life cycle cost approaches are not appropriate to generate estimates across each design, particularly in the ambiguous early stages of acquisition. This research focuses on the development of a draft lifecycle cost model framework to cover the acquisition of a system from conception to decommissioning. The framework leverages existing DoD and Army historic cost data sources and cost estimating software tools to generate the cost domain information required for tradespace exploration and visualization. Two case studies exercising the framework are presented.

Trade Space Analysis: Informing Military Acquisition Decision Making

[28 Oct 15, 1615-1645, Rm 4]

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Keywords: Trade Space, Trade Space Analysis, Decision Analysis, Case Study, Analysis of Alternatives (AoA)

ABSTRACT: Army and Joint leaders are under increased pressure to make cost informed decisions that deliver highly effective future warfighting capability in a fiscally constrained environment. Multiple factors, both operational and economic, must be balanced against numerous stakeholder needs with potentially contradictory goals and year-to-year budget fluctuations. It is essential that the Army analytic community provide decision makers with insights that highlight the trade space that balances cost, effectiveness, affordability, and risk to underpin their decisions. A common framework to capture critical decision elements and de-conflict stakeholder goals is required across the Army analytic community in order to rapidly analyze and trade multiple factors.

This presentation will introduce definitions associated with trade space and highlight common elements associated with conducting trade space analysis.

Military Value Analysis (MVA)

[29 Oct 15, 0945-1015, Rm 4]

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Keywords: Stationing analysis, decision analysis

ABSTRACT: The Army is currently drawing down the force; from the previously announced draw-down to 490,000, they will continue to reduce even more. With each reduction in force, the Army will reduce the number of brigade combat teams (BCTs) and requires analysis to aid in the decision of which installations from which to remove these BCTs. To inform potential force reduction decisions, the Center for Army Analysis (CAA) uses the Military Value Analysis (MVA) model to measure the relative value of installations based on their capabilities in support of BCTs (e.g., maneuver space). The MVA model uses multi-objective decision analysis to assign a value score to each installation, ranking them in a 1-to-N list. MVA is one of several tools CAA is currently developing or updating to support decision makers in stationing analysis.